THURSDAY, JULY 5, 1877

THE CAXTON EXHIBITION

THE exhibition just opened at South Kensington to commemorate the 400th anniversary of the first authentic publication issued from an English press, is one that must appeal to all who can read, and possesses an interest for the man of science from various points of view. We need not repeat the many platitudes that have been uttered and are now likely to be reiterated on the vast importance of the invention of printing by means of movable types. It was a gift to the people of Europe of a pair of intellectual seven-leagued boots wherewith to tread the path of culture; progress during the last 400 years has been beyond all proportion more rapid than during any previous period, and while no doubt other causes have been at work, the strongest impulse has been received from the invention so interestingly illustrated at South Kensington. Mr. Gladstone, in his speech on Saturday, stated that he did not think the invention of movable types in itself anything very extraordinary, and wondered that it had not been blundered on long before the time of Gutenberg and Fust. But the same might be said of most inventions in their first rude forms; we who are accustomed to locomotive engines and ocean-going steamers, for example, are apt to wonder how the world was so long in hitting on these applications of steam. But the truth is that in art as in nature no stage is reached by a leap; it requires a collocation of many little circumstances before any new form is ripe for development. And probably, if we could minutely trace the precedents of the invention of printing, we might find that it was the most natural thing possible that it should have taken place just when it did and not before. Probably all the material conditions or "environment" may have reached the proper stage a century before the actual invention, but then there was no Gutenberg or Fust (or whoever the genius was, for this is no place to discuss the much-discussed question) with the requisite discernment to perceive this, and the practical skill to proceed in the direction indicated by the conditions. It is curious that all the extant remains of the work of the earliest known printers are really wonderful in beauty of execution, which makes one doubtful if we have any of the very earliest specimens, and whether the date of invention should not be pushed further back than the accepted one.

The exact date of the invention, however, has not been satisfactorily ascertained. That it was complete by the year 1450 there seems no doubt, and by the year 1500 printing-presses had been set up in 220 places in Europe, and many books, mainly editions of the classical writers, and religious books, were in circulation by their means. Mainz was the city in which the new art reached its first full development, spreading thence to Haarlem and Strassburg, from Haarlem to Rome, 1466, by Sweynheym and Pannartz, who are said to have been the first to make use of Roman types, to Paris in 1469, to England about 1474, and to Spain in 1475.

The exact date of the introduction of printing into England is not certain; it may have been 1471, it was not later than 1477, the date of the publication of Caxton's "The Dictes and Sayings of the Philosophers," the first book certainly printed and published in England, at the Almonry at Westminster Abbey, where Caxton set up his press; it is to commemorate this event that this year has been chosen for the Caxton celebration. There is a story that a press was set up at Oxford a few years before Caxton's at Westminster; but the evidence for this statement is quite untrustworthy. The first English book printed was by Caxton at Bruges, probably in the year 1474, "The Recuyell of the Histories of Troye." It was at Bruges, where Caxton lived in his capacity of mercer, a man of great importance, and in the retinue of the Duchess of Burgundy, that he learned the new art of printing from Colard Mansion; when he brought the invention to England he was probably about fifty years of age, having been born in the Weald of Kent somewhere about 1420: nearly all dates connected with Caxton are very uncertain.

According to Oldys, the first book in which Caxton had any hand is one which may very fairly be considered as connected with natural science. Its title was "Bartholomeu de Proprietatibus Rerum," said to have been printed while Caxton was at Bruges in the retinue of the Duchess of Burgundy. The work is a kind of natural history, by Bartholomew Glanvill, a Franciscan friar, who flourished about 1360, explaining more especially the nature and properties of the beasts, birds, fishes, stones, &c., mentioned in Scripture. The work had already been translated into English in 1398 by John de Trevisa, and the translation was printed in England, probably on the first paper made in this country, by Wynkyn de Worde, after Caxton's death. It is only right to state, however that according to Mr. Blades, the great authority on all connected with Caxton, no impression of the edition in which Caxton is said to have had a hand, has ever been found.

Caxton, who died in 1491, although he published from his press at Westminster a wonderfully large and varied collection of works, does not appear to have been attracted to any bearing on science, strictly so called. Probably Mr. Gladstone hit on the reason in his estimate of Caxton's character when he spoke of him as a thoroughly practical Englishman who went in only for what would pay. The "Image or Mirror of the World," one of the popular books Caxton translated from the French, treats, however, of a vast variety of subjects after the imperfect natural philosophy of the day. We have an account of the seven liberal arts; of nature, how she worketh; and how the earth holdeth him right in the middle of the world. We have also much geographical information, amongst which the wonders of the Inde occupy a considerable space. Meteorology and astronomy take up another large portion. The work concludes with an account of the celestial paradise. There are twenty-seven diagrams explanatory of some scientific principles laid down in this book; and eleven other cuts illustrative of other subjects treated in the work. The work was translated by Caxton in 1481, but the first edition has no printer's name, place, or date. The history of the "Mirror of the World" may be summed up thus:—Before the middle of the thirteenth century an unknown author wrote in Latin "Speculum vel Imago Mundi." In

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1245 this was turned into French metre by the Duc de Berry; in 1464 this was turned into French prose, and from this text Caxton took his translation.

Even abroad the proportion of scientific to other classes of works issued from the early printing presses was comparatively small; but this may be satisfactorily enough accounted for by the fact that there were then comparatively few really scientific works in existence. From the Italian presses a very large number of arithmetical and geometrical works were issued at the end of the fifteenth and beginning of the sixteenth century. The Alphonsine tables were printed at Venice in 1483; but one of the earliest works in any way connected with science must have been a folio sheet, "Conjunctiones et opposiciones solis et lunæ," dated 1457; the place of publication we have been unable to ascertain. There is a "Gerardis Cremonensis Theoria Planetarum," quarto, dated 1472, and an Albertus Magnus "Opus de Animalibus," printed at Rome in 1478. Other early printed works which, considering the time, may be classed as scientific, are "Questiones Johannis Cunonici super octo libros Physicorum Aristotelis" (Padua, 1475); "Garetani de Thienis in Meteor. libros Aristotelis Expostio" (Padua, 1476); "Prognosticon," a meteorological work published at Venice in 1485. But when we come into the next century the number of strictly scientific works published in England and other European countries increased with amazing rapidity, and we may say has gone on increasing in ever enlarging proportion ever since. The first English translation of Euclid by Billingsby is said to have been published in 1570.

It is a small thing that books of science are all but unrepresented in the Caxton Exhibition; these could no doubt have been obtained had they been sought for; but the object of the exhibition is simply to illustrate the origin and growth of the art of printing, which has been an inestimable boon to science as it has been to every other form of human activity, and the man of science owes as much gratitude to its inventors, and to Caxton its ntroducer into England, as does the worker in any other department of culture. Happily, as we hope to show, science has been able to some extent to repay her debt by importing improvements into the art which would not have been possible but for her researches.

THE DEVELOPMENT OF THE OVUM

Bütschli on the Earliest Developmental Processes of the Ovum, and on the Conjugation of Infusoria.

Studien über die ersten Entwicklungsvorgänge der Eizelle, die Zelltheilung und die Conjugation der Infusorien. Von O. Bütschli. (Frankfurt, 1876.)

FEW subjects can be more important in their bearing on biology than the more prominent of those considered in this volume. It now rests on a morphological basis which will never be shaken, that there has been a procession of the most complex animal forms from simpler and still simpler ones, until we reach eventually the ultimate of organised simplicity. There may be difficulties n the way, but they are as nothing to the overwhelming evidence which morphology provides in its support; doubt, indeed, is no longer possible; and every year diminishes the circumscribed area of difficulty. But our knowledge hitherto of the developmental processes which take place in the earlier states of the simplest elementary organisms is wholly incompetent. Much labour has been expended, and doubtless good work has been done; but as it at present stands, it is conflicting, crude, and essentially wanting in coincidence and correlation. The work before us is the result of an attempt on the part of its author to penetrate farther into the matter than his predecessors, and by completer knowledge to harmonise or explain away conflicting evidence and doubtful interpretation, and if possible to give a sequence to the morphological processes in the simplest ova, and in the least apparently organised of animal forms.

From the smallness of the space at our disposal all consideration of the second subject discussed in this volume must be passed over. It deals with cell and nucleus fission generally; but as it is chiefly theoretical, we may the more readily omit it, merely remarking that the author concludes that there is a fundamental harmony in the method of fission in the cells of both animals and plants; a conclusion which it may be fair generally to admit; but in the minute detail, only discoverable by prolonged research, there will be found palpable differences.

That which gives distinction, and to some extent importance to the book, is (1) its minute and practical investigation into the earliest changes effected by development in the ova of some of the more lowly organised animal forms; and (2) the abundance of data which it appears to provide for the support of a new theory of propagation amongst the infusoria, which Bütschli propounds and advocates.

The embryological researches under the first head were conducted principally upon the ova of the Nematoid worms and the Rotifers. To a limited extent the living egg was studied; but the greater part of the results are derived from investigations of the ova treated with acetic acid. This is greatly to be regretted. The difficulties which present themselves in the minute examination of such ova in the living condition, are doubtless great, indeed complete results could scarcely be obtained from this alone. But undoubtedly the continuous examination of a set of living ova in process of development should be carried on simultaneously with every method of treatment which will reveal structure and change in ova of the same form in the dead condition. Only in this way can every possible mutation be traced, and its correlation and sequence be established.

It is extremely difficult to distinguish even striking discoveries in this direction from the manifold claims put forward by the many observers. We must state generally the facts as they at present appear, and seek to indicate the points specially claimed as new by Bütschli. It is now well known that the ovum is not suddenly formed, and then stimulated into new activity by fertilisation. It evidently, in its very lowliest condition, goes through a process of internal growth and development; after which apparently it perishes unless fecundated. In 1864 Balbiani endeavoured to prove that besides the *germinal vesicle*, there existed one still more important, which he called the embryogenic cell or vesicle in the ovarian ovum; and it was held by leading embryologists

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